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Effect of FinTech on cash holding: Quarterly evidence from Nigeria

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ABSTRACT

The operational activities of FinTech (Financial technology) have restyled the operational functionalities of the classical financial system in terms of cash holding. The purpose of this study is to scrutinize FinTech's effect on cash holdings in Nigeria. Using quarterly data collated from the Central Bank of Nigeria from 2009 Q1-2020 Q4. The cointegrating nexus was estimated using the autoregressive distributed lag/bounds test model (ARDL) and the error correction model (ECM) approach. The Phillips-Perron unit root test was adopted to determine the stationarity properties of the series and their order of integration. Empirical results show the existence of a positive long run nexus between FinTech indicators of mobile banking (MOB), point of sales (POSs), Internet banking (INB), automated teller machine (ATM), and cash holding within the quarterly period under consideration. The ECM results of the short-run divergent factors of economic and financial vagueness, poverty, and literacy, among others, structural and institutional factors influencing the dogged cash transactions in Nigeria, converge back to equilibrium at 90% for ATM, 58% for POS, MOB at 67%, and WEB at 64%, respectively. This study expands its frontiers to accommodate exchange and interest rates as vital determinants of cash holding. The ARDL result offers a varied empirical perspective in contrast to the predominantly employed classical linear regression. Given the statistical limitations associated with findings derived from a singular model, it is imperative for regulators to possess a comprehensive comprehension of the operational mechanisms of Financial Technology (FinTech). This understanding would enable them to formulate appropriate policies that foster the adoption and utilization of FinTech platforms.

Contribution/Originality: This study contributes to the extant literature by introducing the dynamic autoregressive distributed lag/bounds test model (ARDL) and the error correction model (ECM) approach to argue that FinTech adaptability or cash handling fees may not diminish cash holding in the short-run where crimes and their proceeds are particularly weighty in Nigeria. But it may diminish cash holdings in the long-run due to the effectiveness of monetary policy on cash holdings. The use of the ARDL provides a diverse empirical position from the predominantly used classical liner regression.

1. INTRODUCTION

Rapid technological advancement, especially in finance, has a significant impact on the dynamics of the global economic and financial space. Financial technology (FinTech) is the fusion of finance and information technology into financial system business activities to enhance payment, risk management, networking channels, and financial intermediation, among others. Its operational functionalities have redesigned the business activities of the classical financial service space and also birthed one of the most keenly debated economic subjects: cash holding (money demand). Given its effect on monetary policy and other dynamic facets of macroeconomic policy. Money demand is a vital macroeconomic and monetary policy element, inferring that economic agents desire to hold liquid assets for transactional, speculative, and precautionary motives (Serletis, 2007).

Throughout the course of several decades, the validity of the money-demand argument has been further substantiated due to the lack of success exhibited by the money-demand model proposed by Keynesians and Monetarists during the 1960s and 1970s, as well as their contemporaries. These models have failed to withstand the test of time. The variations in financial market performance and the failure of monetary aggregate targeting pave the way for inflation targeting in countries like the United States, Latin America, New Zealand, the United Kingdom, Canada, and Sweden (Darrat, 1986; Goldfeld, Fand, & Brainard, 1976; Mishkin, 1999; Roley, 1985). The variation in classic money demand specifications is characterized by large autocorrelated errors and improbable parameter estimates. A plausible explanation for the instability and misspecification is financial liberalization, which is primarily attributed to institutional and regulatory changes (James, 2005). The plausible explanation is substantiated by the new institutional and regulatory policy to reinstate charges on cash holdings and deposits over ₦500,000 (CBN, 2019a). This policy is underpinned by the need to reassure and rebuild consumers' confidence in FinTech payment platforms for all cash transactions, reduce the 86.7% cash base transaction rate, spur economic growth, and account for the total amount of money in Nigeria's calculation. The investment of USD55.3 billion in 2019 on FinTech by startup companies globally has led to an upward trajectory in the value of cashless transactions enabled through the e-payments platforms of mobile banking [MOB], point of sales [POSs], Internet banking [INB], and Automated teller machines [ATM], among others (see Figure 1) to achieve the cashless economic policy.

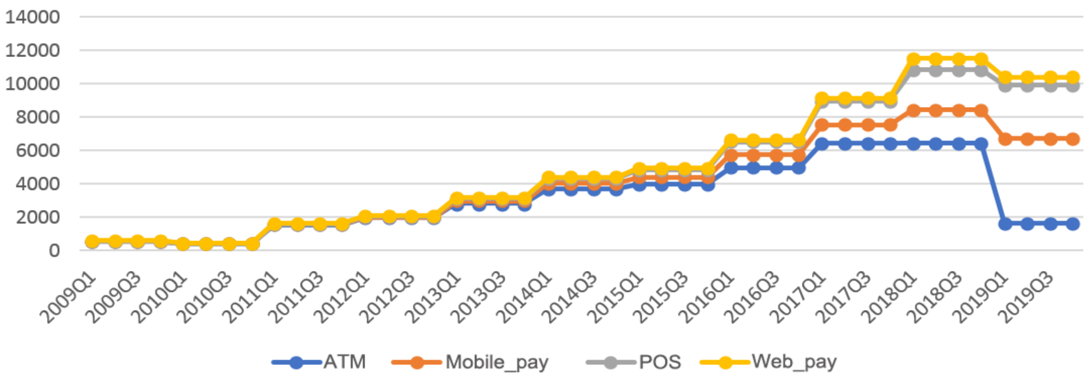

Figure 1. Transactional value of retail digital platforms (2009Q1–2019Q4).

The upward trajectory begs the question: to what extent has FinTech abridged the urge for cash holding in Nigeria? And have the operational elements like payment systems and all-inclusive, cutting-edge infrastructures logically encouraged FinTech to develop in Nigeria?

In an industrialized financial-economic climate, Attanasio, Guiso, and Jappelli (2002) and Alvarez and Francesco (2009), among others, reported a significant effect of FinTech on demand for money. In India, Adil, Hatekar, and Sahoo (2020a) in Uganda Nampewo and Opolot (2016) argued on the contrary. In emerging economies, Uche and Ehikwe (2001) focus on the evolution of digital finance; Dandago and Rufai (2014); Abor, Amidu, and Issahaku (2018); Rahmawati, Sarno, Fatichah, and Sunaryono (2017); Udo, Abner, Inim, and Akpan E (2020); and Salami (2018) focus on bank fraud, economic growth, and financial inclusion, among others. For the objective of policy evaluation, it is imperative to recognize the effect of FinTech on the business activities of the financial sector prior to the reinstatement of the cash holding fee.

Despite the divergent FinTech and cash holding nexus, Fujiki (2020) and Grüschow, Kemper, and Brettel (2016) observed that the cashless policy significantly influences emerging market operational structures.

The realization of the cashless economic goal through FinTech exclusively depends on the proclivity of economic actors to ardently adopt e-payment holistically.

FinTech adaptability or cash handling fees may not diminish cash holdings where crimes and their proceeds are particularly weighty. This is evidenced in Nigeria, where kidnappers request ransom in cash, small and medium-scale enterprises reject cash transfers, and there is poor network coverage, poor bank-customer relations, and FinTech transfers debt without credit or reversal, among other things. The identification of the FinTech and money demand nexus effect is critical to the development and implementation of Nigeria's cashless policy.

2. RELATED LITERATURES

2.1. Contextual Review

2.1.1. FinTech and Money Demand Nexus

Inclusive growth and development potentials embedded in FinTech are like double-edged swords, one enhancing economic growth and financial inclusion and the other instigating money demand instability (Apere, 2017; Nnaeme, Patel, & Plagerson, 2020). Understanding the factors instigating money demand instability is vital for achieving 21st-century economic and financial objectives. Dunne and Kasekende (2016) and Grüschow et al. (2016) posit that the diverse FinTech platforms impact money demand distinctively, as financial instrument derivatives like ATMs and debit cards can significantly lower transaction costs by shifting the cash management burden to FinTech operations. FinTech is a significant promoter of financial inclusion (Nnaeme et al., 2020) and economic growth (Grüschow et al., 2016). According to Grüschow et al. (2016), the various FinTech platforms present diverse costs and efficiency.

Keynes (1936) posits that the liquidity preference theory of the money demand function classically serves as a FinTech and economic growth transmission conduit. Keynes (1936) characterized the motives for cash holding as types of liquidity preference motives. For transactional and preventative purposes, an increase in money demand increases income and price levels, whereas liquidity preference is held up by cash holding costs for speculative purposes. Empirical reviews attribute financial reforms and the advancement of analytical econometric techniques to the stability of money demand. The mixed findings of Joseph, Larrain, and Ottoo (2013) revealed that money demand correlates positively with real income and price level and adversely with cash holding opportunity cost. In Nigeria, the mixed results of Ajayi (1977) revealed that money demand stability positively influences income on the monetary aggregate and non-significantly influences the rate of interest on aggregate monetary policy. The findings of Ajayi (1977) are substantiated by Folarin and Asongu (2019); Asongu, Folarin, and Biekpe (2019), among others, note that money demand stability or instability function is influenced by financial structure policy.

Ma and Lin (2016) argued that financial sector industrialization diminishes monetary policy effectiveness. In the Eurozone from 1999-2013, Jung (2016) employed the portfolio demand method to scrutinize M3, in light of the 2007-2008 global financial crisis. Findings revealed that M3 is largely stable as a result of factors like opportunity costs and transaction variables. Studies expanding the frontiers of the demand function of money to capture FinTech in emerging economies are scanty. However, empirical studies by Ndirangu and Nyamongo (2015) in Kenya, Fujiki and Tanaka (2014) in Japan, and Lucas Jr and Nicolini (2015) revealed mixed results due to the model, variables of measurement, and method of data collection, among others. Studies in Nigeria employ predominantly annualized time series data and the classical linear regression model. The critics of the predominance of annualized data and the classical regression model argued that the smoothing effect inherent in annualized data presents unrealistic results.

And the results obtained from the use of a single model are statistically questionable, thus recommending the use of high-frequency data and other advanced models.

Tule and Oduh (2016) adopted the generalized method of moments (GMM) model to examine financial innovation's effect on monetary policy. Results show that FinTech boosts interest rate transmission channels, monetary policy transmission channels, and the financial system's efficacy.

In Japan, Fujiki and Tanaka (2014) employed an instrumental quantile regression approach on the household-level survey. The results indicate users of ATM cards are cash-based compared to non-users.

2.1.2. FinTech and Cashless Policy Evolution in Nigeria

The evolution of FinTech can be traced back to the 1996 consortium bank Smart Card project. The recent geometric increase in FinTech growth around the world is a result of the new social structure made possible by network coverage and smartphones to promote financial inclusion, lower banking service costs, and increase the effectiveness of monetary policy(CBN, 2011; Udo et al., 2020; Ujunwa et al., 2022). The widespread adoption of M-Pesa in Kenya also accounts for the reshaping of digital banking products. The 85.84% financial inclusion rate in Kenya is evidence of this. In Nigeria, FinTech's geometric growth accounts for 51.41% of financial inclusion, South Africa 68.4%, Rwanda 55.75%, Mauritius 92.71%, and Burundi 7.50%. Similarly, the Nigerian Inter-Bank Settlement System (NIBSS) report revealed approximately 43.6 million Bank Verification Numbers (BVNs) enrolled by adult Nigerians between 2015 and 2018, making them both data and financially included.

The Nigerian FinTech products fall under the wholesale and retail digital product categories; the real-time gross settlement system (RTGS) is a component of the wholesale digital product, whereas the retail digital product encompasses direct e-payment indicators like ATM, POS, Web Pay, and mobile Pay, which are the focal areas of this study. To eliminate the security trials associated with managing high cash holding costs. In April 2011, the central bank of Nigeria (CBN) adopted the cashless policy. To forbid third-party transactions of more than ₦150,000 and the provision of transit lodging services to merchant customers. Similarly, the policy imposes costs on cash holdings and deposits above ₦500,000. At the implementation stage, the policy was suspended. Regardless of its suspension, CBN has continued to issue a number of directives to develop e-payment and regulate financial services.

In April 2016, the operational guideline for e-payment conduits was issued to address retail product functionalities (CBN, 2016). The October 2018 issuances of the licensing and regulating guidelines for payment services focused on including about 56 million adult Nigerians into under banked and unbanked groups. This group embraces those in extreme poverty, on an income less than $2.00 per day, most commonly referred to as the "*Base of the Pyramid*" (Udoh et al., 2018). The various guidelines and policy document directives deepened the bank's business activities, strengthened the consumer protection department to resolve bank-customer-related digital transaction disputes, and restored customers' confidence (Udoh et al., 2018).

The upward trend in the value of digital transactions is clear evidence of the beneficial effect of these policies. The strict pandemic safety restrictions to stop COVID-19 spread in Nigeria had a significant impact on the operational value of the various e-payment platforms in 2020, particularly POS and ATM. However, the impact on other systems, such as Web Pay and Mobile Pay, was minor since customers could complete transactions from the comfort of their homes. On the other hand, the pandemic promotes cash-based transactions, primarily among bigger, small and medium-sized enterprise, while having a catastrophic effect on the $90 trillion global economy (Udo et al., 2020; Ujunwa et al., 2022). It is also conceivable to argue that users of ATMs and POS engage in cash-based transactions, which led to an increase in currency in circulation and currency outside the banking system (see Figure 2). Currency in circulation is a fragment of the total money supply in the public domain. A slight decline in the trajectory in 2021 Q1 after COVID-19 shows a positive impact of FinTech in achieving the cashless policy objective.

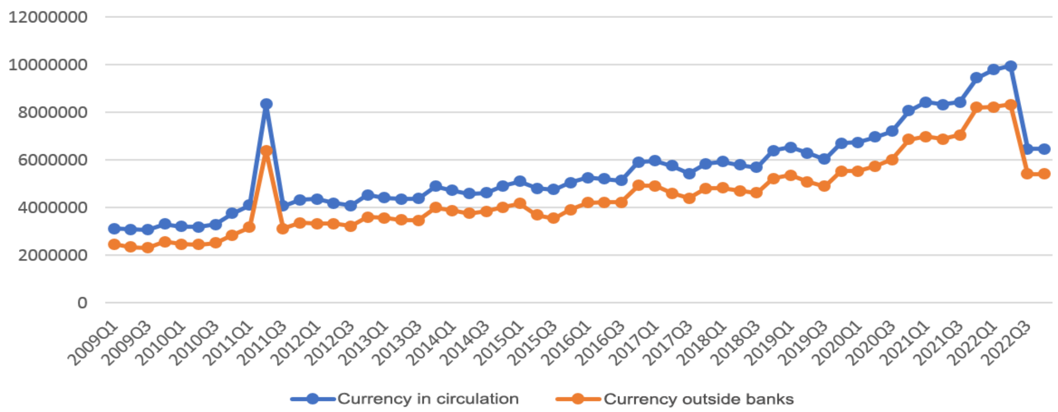

Figure 2. Cash in circulation and outside of banking system (2009Q1– 2019Q4).

2.1.3. Money Demand Determinants

Money and its defining factor are as old as the evolution of man. The longevity, mobility, divisibility, regularity, restricted supply, and acceptability of gold as a legal tender have an impact on the physiognomies of paper money as a legal tender. The constitutional provisions of modern society provide the legal justification for the recognition of paper money as legal tender; its rejection or abuse is considered a criminal offense. The classical economists posit that the value of cash flow and prices depict the medium of exchange nexus. The tangible nature of money provides transaction confidentiality, while its shortcomings pave the way for the emergence of FinTech and a shift from cash-based to cashless transactions. However, this shift raises the question of the extent to which FinTech-driven cashless policies can fully eliminate cash-based systems. In industrialized economies, Jiang and Shao (2020) observed that an increase in POS transactions favourably reduces the value of cash-based businesses but may not eradicate it due to the level of financial exclusion and financial literacy. Cash-based systems will persist in all economies, according to Fujiki (2020) in Japan, although greater financial literacy will reduce cash hoarding. In Italy, Ardizzi, De Franceschis, and Giammatteo (2018) posit that cash-based systems are driven by corruption, country peculiarities, and money laundering activities. Tran (2019) and Li, Fung, Fung, and Qiao (2020) collaborate on these claims, stating that political ties and structural leakages are forces behind the cash-based system. On earth, evidence in Nigeria also substantiates these claims. In Europe, Adão and Silva (2020) attributed monetary policy and interest rate effectiveness channels to recurrent changes and firm cash holdings. In establishing FinTech's cause-effect nexus on cash holding in Nigeria, the demand function model frontiers are expended to incorporate the distinct role of FinTech on cash holding.

2.1.4. Theoretical and Model Specification Framework

Real money demand and real income are scale variables in the classical money demand model. The opportunity cost of money demand is proxied by the interest rate, inflation rate, and exchange rate (Qayyum, 2000; Abdul Qayyum, 2005 Ujunwa et al., 2022). Monetary policy's effectiveness is heavily reliant on the responsiveness and elasticity of its determinants (Fujiki & Tanaka, 2014). The money demand function is expressed as:

$$\left(\frac{M}{P}\right) = f\ (y, i) \qquad (1)$$

Where: M = nominal monetary aggregates; P = price level; $\left(\frac{M}{P}\right)$ = real monetary aggregates,

y = money demand of real income and the opportunity cost of cash holding, which include the inflation rate (IFR) and exchange rate (EXCH) (Ben-Salha & Jaidi, 2014).

Fujiki and Tanaka (2014) adopted the modified traditional money demand function and expressed it as:

$$M = lnD\alpha\ (U)\ +\ X\ \beta(\mu) \quad (2)$$

Where ln = natural logarithm; M = ratio of CIC to broad money (Cash holding) is determined by variable D, denoting a direct measure of FinTech. X = vector of explanatory variables, while U is the scalar random variable that is the aggregate of all the unobserved factors affecting the structural outcomes of Equation 1.

$$lnD\ =\ \delta\ (ATM;\ POS;\ WEB, MOB) \quad (3)$$

D = Unknown function (δ) depending on the transactional values of direct measures of FinTech ATM = Automated Teller Machine; POS= point of sales; WEB= Web Pay; MOB= Mobile Pay. Equation 2 is Re-expressed as:

$$\left(\frac{CIC}{M3t}\right) = \delta_1\ lnD_t^i\ +\ \delta_2\ lny_t\ +\ \delta_3 ifr_t\ +\ \delta_4\ lnrex_t\ +\ \mu \quad (4)$$

Where: IFR = inflation rate proxy by All Consumer Price Index Items; REX = real effective exchange rate (cash holding opportunity costs).

The superscript in Equation 4 allows for the consideration of the various FinTech products as expressed in Equation 3. $\left(\frac{CIC}{M3t}\right)$ = measure of cash holding.

Retail financial products are adopted as proxies of FinTech to expand the frontiers of the extant literature and offer an empirical-based policy framework.

3. ECONOMETRIC MODEL

The adopted dataset is a high-frequency quarterly time series collated from the CBN statistical database from 2009 Q1-2020 Q4. The study variables were: total broad money (M_3), money demand indicator. The ATM, POS, WEB, and MOB transactional values proxy FinTech. The modified money demand function model of Fujiki and Tanaka (2014), capturing the classical money demand determinants of real income, real effective exchange rate, and inflation rate, was used. The inflation rate was adopted given its superiority over the domestic interest rate as established by Folarin and Asongu (2019), among others, in Nigeria and Africa. Real GDP proxy income variable, Consumer Price Index All Items (CPI-A) proxy opportunity cost of cash holding, and real effective exchange rate proxy the rate of exchange.

3.1. Model

The ARDL-bound test was adopted for its prowess in handling small data samples and variables integrated from diverse orders. The model eradicates serial correlation and variable endogeneity glitches to test for the long-run nexus as expressed in Equation 4.

The ARDL model is expressed in Equation 5.

$$\Delta\left(\frac{CIC}{M3t}\right)\ =\ \delta_0\ +\ \delta_1\left(\frac{CIC}{M3t}\right)_{t-1}\ +\ \delta_2 lnD_{t-1}^i\ +\ \delta_3 RGDPy_{t-1}\ +\ \delta_4 ifr_{t-1}\ +\ \delta_5 lnrex_{t-1}\ +\ \delta_6 Trend\ +$$
$$\sum_{j=0}^{i}\tau 1j\Delta\left(In\left(\frac{CIC}{M3t}\right)_{t-1}\right) + \sum_{j=0}^{m}\tau 2j\Delta lnD_{t-1}^i + \sum_{j=0}^{n}\tau 3j\Delta RGDP_{t-1}^i + \sum_{j=0}^{n}\tau 4j\Delta IFR_{t-1}^i +$$
$$\sum_{j=0}^{n}\tau 5j\Delta Inrex_{t-1}^i + + \mu_t \quad (5)$$

To estimate the F-statistics in Equation 5, Pesaran, Shin, and Smith (2001) advocated for lag value restrictions. The F-statistics value indicates a long-run nexus among the variables.

3.2. Decision Rule

1. *F*-statistics value above the *upper bound*, H_0 is rejected (co-integrated).
2. *F*-statistics value below the *lower bound*, H_0 cannot be rejected (not co-integrated).
3. *F*-statistics value between the *upper and lower bounds* is (inconclusive).

The ECM was estimated to confirm the speed of convergence from short-run disequilibrium to long-run equilibrium. The ECM provides the short-run coefficient without losing the long-run information and is specified as

$$ECT = \left(\frac{CIC}{M3t}\right) - (\vartheta_0 + \vartheta_1 \mathrm{T} + \delta_2 lnD_t^i + \delta_3 RGDPy_t + \delta_4 ifr_{t-1} + \delta_5 lnrex_t) \qquad (6)$$

The trend was incorporated into the model as a result of the significance of the regression result. The ECT results in Equation 6 are fused into the dynamic form and specified as:

$$\Delta\left(\frac{CIC}{M3t}\right) - (\gamma_0 + \gamma_1\, lnD_t^i + \gamma_2 RGDPy_t + \gamma_3 ifr_{t-1} + \gamma_4 lnrex_t + \tau ECT_{t-1} + \varepsilon_t) \qquad (7)$$

Where: RGDP = economic growth, and RE = exchange rate and IF = interest rate, τ = error correction term that explains the speed of divergent from the short-run disequilibrium to long-run equilibrium.

A significant and negative τ is expected after an outside shock. Indicating convergence speed with a range of 0 to1. (0) Inferred no convergence, while (1) inferred full convergence from the shock. Positive τ values indicate explosive or no equilibrium convergence following an exogenous shock.

4. EMPIRICAL ANALYSIS

4.1. Data Description

The results reported in Table 1 show the mean, median, and indicators of dispersion. Normality is established from the values of skewness, kurtosis, and Jarque-Bera probability. The mean value of ATM transactions is ₦3139.16 bn, higher than the mean values of MOB, POS, and WEB for the period. WEB is the least-used fintech platform. The low patronage can be attributed to the increasing rate of web fraud, network volatility, and poor bank-customer relationships in resolving debt without credit challenges, among others. The average value of ₦ 4,871,384.00 bn for CIC is higher than the mean value of ₦ 3,890,604.00 bn for currency outside banks (COB), denoting a cash-based economy. The skewness statistic values show that the series are positively skewed except for M_3, which is negatively skewed. The kurtosis statistic values of ATM, COB, M2, IFR, REX, and real gross domestic product (RGDP) are platykurtic, MOB and WEB leptokurtic, and POS and CIC mesokurtic. The series are normally distributed based on the Jarque-Bera probability except for MOB, POS, and WEB, which are not normally distributed.

Table 1. Basic descriptive statistics of variables under study in Billions (₦).

Variables	ATM	MOB	POS	WEB	CIC	COB	M3	IFR	REX	RGDP
Mean	3139.16	900.37	798.27	171.30	4871384.0	3890604.0	22.39	519.46	85.64	90533.80
Median	2828.93	346.46	312.07	84.150	4779751.0	3856763.0	22.64	476.80	82.87	90136.98
Std. dev.	2086.28	1460.20	1049.10	202.920	1144544.	970287.2	1.48	195.13	9.77	30197.18
Skewness	0.34	2.14	1.29	1.64	0.45	0.22	-0.34	0.40	0.02	0.23
Kurtosis	1.85	6.48	3.27	4.21	3.36	2.55	2.35	2.21	1.52	2.15
Jarque-bera	3.28	55.86	12.42	22.56	1.77	0.72	1.62	2.33	4.01	1.71
Prob.	0.1937	0.0000	0.0020	0.000	0.4113	0.697	0.444	0.310	0.134	0.42

Note: Mobile banking (MOB), Point of sales (POSs), Internet banking (INB), and Automated teller machine (ATM), Currency in circulation (CIC), Currency outside banks (COB), Money Supply (M3), Interest rate (IFR), Exchange rate (REX), and Gross domestic product (RGDP).

Table 2 reports the NG-Perron unit root results. Series are stationary and integrated at level order I(0) and first difference I(1). The prerequisite for adopting the ARDL model is satisfied.

4.2. Co-Integration Analysis

The long-run cointegrating effect nexus between the various indicators of FinTech and money demand proxy (M3) is stated in Table 3.

The F-statistics values in the models are (< I (1)) critical values at the 5% level. The results revealed a long-run cointegrating nexus between cash holding and fintech indicators. On the premise of cointegration, the ECM was conducted. The diagnostic test result of the BG LM is (>0.5) implying no autocorrelation, while the B-P-G test for heteroscedasticity confirms that the model residuals are homoscedastic.

Table 2. Unit root test.

Variables	MZa	MZt	MSB	MPT	Order of integration
ATM	-20.99***	-3.24***	0.15**	3.16***	I (1)
COB	-16.91***	-2.88***	0.17***	1.54**	I (1)
IFR	-16.21***	-2.84***	0.17***	1.52**	I (1)
M3	-20.99***	-3.24***	0.15**	1.16**	I (1)
MOB	-20.23***	-2.63***	0.41***	3.32***	I (1)
POS	-8.67**	-1.93**	0.22*	3.99***	I (0)
WEB	-20.98***	-3.23**	0.15***	4.35***	I (1)
REX	-20.82***	-3.22**	0.15***	4.39***	I (0)
RGDP	-22.78***	-9.73***	0.02***	0.14**	I (0)
Critical values					
1%	-13.8	-2.58	0.174	1.78	
5%	-8.1	-1.98	0.23	3.17	
10%	-5.7	-1.62	0.275	4.45	

Note: *,**,*** =Levels of Significance 10%, 5% and 1%, respectively.
Mobile banking (MOB), Point of sales (POSs), Internet banking (INB), and Automated teller machine (ATM), Mone supply (M3), Interest rate (IFR), Exchange rate (REX) and Gross domestic product (RGDP)

Table 3. ARDL cointegration test results.

Long run estimate						Diagnostic tests		
						The probability values of the F-statistics		
Variables		Models	Test statistics			BG LM test	BPG heteroskedasticity test	Heteroskedasticity ARCH test (1)
			F-Stat (5%)	I (0)	I (1)			
ATM	RGDP	1,0,2,4,4	8.755	2.56	3.49	0.89	0.60	0.46
	IFR							
	REX							
	M_3							
POS	RGDP	1,1,1,0,0	6.242	2.56	3.49	0.59	0.36	0.20
	IFR							
	REX							
	M_3							
WEB	RGDP	1,4,4,4,4	16.143	2.56	3.49	0.405	0.56	0.33
	IFR							
	REX							
	M_3							
MOB	RGDP	4,4,4,2,4	11.910	2.56	3.49	0.392	0.41	0.85

Note: Mobile banking (MOB), Point of sales (POSs), Internet banking (INB), and Automated teller machine (ATM), Money supply (M3), Interest rate (IFR), Exchange rate (REX) and Gross domestic product (RGDP).

Table 4. Short run error correction estimation (ECM) model.

Models	Variables DP=M3	CointEq(-1)	Coefficient	t-stat	Prob.	Other parameter estimate		
						R^2	Adjust. R^2	DW stat
H_1	logATM	-0.9056	-0.1122	-8.0708	0.000	0.77	0.70	2.31
H_2	logPOS	-0.5875	-0.1478	-3.9743	0.000	0.77	0.70	2.01
H_3	logMOB	-0.6704	-0.6972	-9.6167	0.000	0.87	0.77	2.34
H_4	logWEB	-0.647	-0.5818	-11.125	0.000	0.89	0.81	2.00

Note: Mobile banking (MOB), Point of sales (POSs), Internet banking (INB), and Automated teller machine (ATM).

The ECM results in Table 4 show that the (CointEq (-1) values of (-0.90), (-0.58), (-0.67), and (-0.64) are negative and significant across the four models. Indicating the speed of convergence from the short-run deviation arising to equilibrium at a point in the long run at 90%, 58%, 67%, and 64%, respectively.

Table 5. ARDL long run estimate.

Models	Variable DP=M3	Coefficient	Std. error	T-statistic	Prob.	Other parameter estimate			
						R^2	Adjusted R^2	F-stat	DW
H_1	LOGATM	0.910	0.307	2.958	0.000	0.58	0.53	13.605 (0.000)	2.05
	LOGRGDP	-2.213	1.901	-1.164	0.251				
	IFR	-0.638	0.262	-2.430	0.019				
	REX	-0.238	0.205	-1.167	0.908				
	C	36.968	19.834	1.863	0.000				
H_2	LOGPOS	2.035	0.3282	6.201	0.000	0.74	0.71	28.131 (0.000)	2.41
	LOGRGDP	-7.787	1.8675	-4.169	0.000				
	IFR	-0.529	0.939	0.563	0.617				
	REX	-0.262	0.856	-0.305	0.693				
	C	99.885	20.142	4.958	0.000				
H_3	LOGMOB	0.825	0.042	19.502	0.000	0.54	0.49	11.489 (0.000)	2.08
	LOGRGDP	-5.841	3.877	-1.506	0.140				
	IFR	-0.321	0.239	-1.340	0.187				
	REX	-0.266	0.207	-1.095	0.289				
	C	79.90	41.43	1.92	0.060				
H_4	LOGWEB	0.361	0.380	0.952	0.347	0.54	0.49	9.586 (0.000)	2.07
	LOGRGDP	2.955	1.636	1.806	0.078				
	IFR	-0.410	0.033	-0.123	0.902				
	REX	-0.230	0.216	-1.064	0.293				
	C	-3.434	17.238	-0.199	0.843				

Note: Mobile banking (MOB), Point of sales (POSs), Internet banking (INB), and Automated teller machine (ATM), Money supply (M3), Interest rate (IFR), Exchange rate (REX) and Gross domestic product (RGDP).

4.3. The Long Results

The long results in Tables 5 show the fintech and money demand nexus in Nigeria. A unit increase in the values of ATM and MOB transactions positively and significantly decreases the cash holding desire by 91.0% and 82.5%, respectively, in the long run.

The negative impact of POS at 2.0% can be attributed to consumers' lack of understanding of its operations, poor handling of debit without credit by banks, and a lack of trust and confidence. The non-significant impact of 36.1% for WEB can also be attributed to the same factors negatively influencing POS since both are network-based. The result of this study complements the long-run nexus results of Jiang and Shao (2020) in industrialized economies, Fujiki (2020) in Japan, De Almeida, Fazendeiro, and In_acio (2018), and Tule and Oduh (2016) in Nigeria, among others. The long-run result indicates that exchange and inflation rates negatively influence money demand in the models.

5. CONCLUSION AND POLICY IMPLICATIONS

The dynamic and evolving FinTech structure and regulatory reforms have sustained the debate on the causal effect of money demand. This study examined the efficiency and futility of FinTech in reducing the value of currency in circulation and enhancing the achievement of the cashless economic policy of the government as its prime objective. The retail financial products of ATM, POS, WEB, and MOB proxy FinTech. The ARDL and ECM were adopted to scrutinise the equilibrium nexus. Findings show that ATMs and MOBs significantly reduce cash holding in the long run due to their suitability and acceptability by consumers in Nigeria. The effect of POS on cash holding was non-significant due to consumers' lack of understanding of its operations, poor network coverage, and poor handling of debit without credit by banks, among others. The negative and non-significant impact of WEB can be attributed to poor network coverage and factors associated with POS since both are network-based. The findings and results are collated in the findings of Humphrey (2004) in the USA and Ndirangu and Nyamongo (2015) in Kenya.

The CointEq (-1) short-run disequilibrium nexus between FinTech and cash holding shows that cash-based transactions are still unescapable. Owing to corruption, insufficient information technology infrastructure, policy vacillation, household characteristics, insecurity, and a low level of financial literacy. The speed of convergence to equilibrium in the long run is uneven across the various FinTech platforms due to structural and institutional factors. Cash holding charges in Nigeria may unconsciously spur informal sector growth via diversion of funds to evade costs. Stability in monetary and fiscal policies would significantly condense the enticements for cash holding by households and firms for precautionary and transactional purposes. Findings indicate that cash-based transactions are largely determined by currency denomination structure. An effective review of this structure could be an effective strategy for promoting e-payment via compulsory service payments in public facilities in Nigeria. Corruption and unethical business operational activities should be severely checked through structural and institutional reforms to encourage the use of electronic cards and reduce cash-based transactions.

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